The Atom Bomb, Its effects and How to Meet Them

Home Office Civil Defense
London

Her Majesty's Stationary Office
1953/54

Copied from the original documents and slides by Stephen Redpath-Bergman, 2012.

Documents and slides found in the Civil Defense bunker under the now demolished Bletchley Fire Station, Buckinghamshire, England. These were used as a lecture aid by the the Buckinghamshire Fire Brigade.

NOTES FOR THE INSTRUCTOR

1. THE INSTRUCTOR

The qualities required in a good instructor are as follows:-

(i) Must be PURPOSEFUL
(ii) KNOW the SUBJECT
(iii) Be PAINSTAKING
(iv) ENTHUSIASTIC
(v) Have a DRAMATIC SENSE
(vi) A PLEASING MANNER
(vii) Must have the right ATTITUDE towards the class.

2. THE STUDENT

The student is largely dependent on his five senses for acquiring knowledge. If the training is to be most effective, therefore, it should be directed more or less simultaneously to as many of these senses as possible.

3. THE LECTURE

The Instructor should use every possible device to maintain the interest of his class, and to prevent boredom. Introduce drama, surprise and variety; encourage questions; etc.

The lecture should be short and, if necessary, broken up into small periods. The breaks may be made by means of visual aids, something dramatic, a few test questions or a summary.

4. THE FILM STRIP

The film strip is merely one of the visual aids to instruction and the lesson should be planned and prepared by previewing the strip in conjunction with the notes, so that the best use may be made of the strip in presenting the lesson.

The film strip should not be used as a substitute for demonstration. It should be followed, whenever possible, by demonstration and practical work. (This obviously will not apply to every film strip).

5. THE INSTRUCTOR'S NOTES

The notes given in this booklet are not as they stand, intended to be read to the class, but are designed to assist in the preparation of the lecture.

HOW TO USE THE FILM STRIP

1. Screening and projection should be prepared and checked before the lecture.

2. The projector is best placed as close to the screen as the size of the class permits, and should be central to the screen to minimise distortion of the picture. It should be set high enough to project the image above the heads of the students. The projected picture can generally be raised or lowered by means of milled screws at the bottom of the projector. Before using the projector, make certain that the electricity supply is of correct voltage.

3. Focus the film strip on the screen at the beginning of the lecture. The "focus frame" included at the beginning of the strip is provided for this purpose. If a proper screen is not available, a clean sheet of white cloth can be used provided it is stretched free from wrinkles. Any white, opaque material or surface (e.g. a white wall) will do in an emergency. Total darkness is not normally necessary.

4. Orderly seating helps to create an attitude of attention and may prevent vision being obstructed. A rear row of seats should be at a distance from the screen not greater than 6 times the WIDTH of the projected picture. The front row should be at a distance not less than twice the DEPTH of the projected picture. The seats should be situated within an angle of 30° extending outwards from either side of the projected picture.

5. Film strips should be wound with the emulsion (or dull) side outwards, so that, when threaded, this dull side faces the lamp.

6. The projector should be properly maintained if it is to project the pictures as clearly and efficiently as possible. Lenses and glass aperture plates should be cleaned and polished regularly with methylated spirit or other suitable cleaning fluid, and finished off with dry chamois leather. Aperture plates should not normally be removed.

HOME OFFICE

CIVIL DEFENCE

THE ATOM BOMB ITS EFFECTS & HOW TO MEET THEM

PART 1

"INTRODUCTION"

FILM STRIP C.D. 31

LECTURE NOTES

LONDON : HER MAJESTY'S STATIONERY OFFICE

1954

FILM STRIP C.D.31

The Atom Bomb - its effects and how to meet them

PART I

Introduction

FRAME

1 The H.E. bomb used to attack cities during the last war utilises energy which takes the form of a shock wave known as blast.

2 The explosion of an Atom Bomb releases as much energy as thousands of tons of T.N.T. and releases energies in three forms: the first is Heat.

3 The second is Radiation.

4 The third is Blast - this latter is by far the most important.

5 The effects of an Atom Bomb on a selected target depend on three factors.

First-Nature of the Target

Second-Power of the Bomb

Third-Height at which Bomb is detonated

6 For the purpose of this lecture we shall assume that the target will be a large British City and that the bomb is equivalent to the explosive force of 20,000 tons T.N.T. This size is known as the nominal bomb.

7 The assumed height of detonation will be 1,000 ft. above the city. At about this height maxim destruction would be caused to a British City. To explode the bomb below this height would reduce the area of destruction; to explode it at a greater height would reduce its power to destroy large steel framed buildings, or to cause casualties if the population had reasonable shelter.

FRAME

8 We will now examine the three kinds of effects. First effect - Heat. Heat generates at the moment of explosion and produces what is called the "ball of fire", this expands rapidly and as it cools it shoots up into the atmosphere. The photograph shown was made with an exposure of one millionth of a second and shows the extreme beginning of an Atomic explosion.

9 Heat radiation travels outwards in all directions from the fire ball with the speed of light.

10 Atmospheric conditions play an important part in the effect of Heat. On a misty or foggy day the range of the heat flash will be greatly reduced.

11 Effect No.2 is Nuclear Radiation. There is an immediate radiation of gamma rays and neutrons at the time of the explosion. These are centred in the rising ball of fire which carries them out of range in less than a minute after the explosion.

12 Gamma Rays travel at the speed of light in all directions from the explosion. They have a harmful effect on the body but at a range of $\frac{3}{4}$ of a mile you will, even in the open, have a 50/50 chance of survival. Beyond this point the power of the rays falls off rapidly.

They do not make things they strike radioactive.

13 Neutrons are atomic particles produced by the explosion which have the power to injure human beings and to make some materials they strike radioactive. Their lethal range is, however, less than the lethal range of the gamma rays.

14 The second form of Radiation is Residual Radiation. This consists chiefly of Gamma Rays which arise from deposited fission products and to a lesser extent from material made radioactive by the neutrons.

Since only a small fraction of Radioactive material reaches the ground the danger from Residual Radiation is much less than from Immediate Radiation. Residual Radiation is less concentrated than the Immediate Radiation and only becomes dangerous if a person is exposed for a long time. In the case of a bomb detonated at 1,000 ft. there would be little danger from Residual Radiation.

15 The third effect is Blast. This is caused by a shock wave resulting from the sudden and terrific heat produced by the release of Atomic Energy.

16 With the normal type of explosive used in the last war the bomb usually exploded on or after impact with the ground, thus the side of the building nearest to it would be affected.

17 In the case of an Atom Bomb detonated in the air, the blast effect is largely downwards and outwards. Beneath the explosion it affects all sides of a building simultaneously. Further away it becomes a sideways push. The blast effect will severely damage buildings up to a distance of a mile and a half from the explosion.

18 If the Atom Bomb is detonated on impact, or below ground level the effect is somewhat different. A very deep crater would be formed surrounded by a great ring of crater debris. Though the blast effect would be less than with the air bursts there would be a large area round the crater where buildings would be collapsed by earthshock effects.

19 The danger from Heat flash and Immediate Radiation would be lessened since the insulating properties of the crater would absorb the greater part of them, but the danger from Residual Radiation would be greatly increased in the vicinity of the crater. The same applies to an under-water explosion.

20 The area affected from a nominal bomb detonated at 1,000 ft. may be divided into three circles. The first will have a radius of a $\frac{1}{4}$ of a mile from the point below the explosion, which is known as "Ground Zero", within the $\frac{1}{4}$ mile circle the target will be completely devastated.

21 The second circle drawn at a radius of $\frac{3}{4}$ of a mile from ground zero will contain a large number of buildings totally or partially destroyed.

22 The third circle at a distance of $1\frac{1}{2}$ miles from ground zero marks the limit of houses suffering severe structural damage. Outside this area the damage will be progressively less severe, tailing off at about two miles.

23 If a nominal bomb was detonated at 1,000 ft. over London the area affected would be of the relative size indicated by the small circle which has a diameter of three miles.

24 Over Birmingham this size.

25 Over Glasgow this size.

26 Over Liverpool this size.

27 Let us see what the effects would be if an atom bomb burst over an imaginary British city called Sheffingham with a population of half a million people. The air raid warning has sounded and people are in the shelters.

The Atom Bomb has burst over Sheffingham. Within a radius of $1\frac{1}{2}$ miles from ground zero a large number of buildings are destroyed and many are burning

28 If we take a sector of Sheffingham we can study this in detail and presume the effects are similar at comparable distances from ground zero in any direction.

FRAME

29 Here is a view about a $\frac{1}{2}$ of a mile from ground zero before the explosion.

30 Here is the same view after the explosion. The entire area is devastated. As a result the fires will be of little consequence, but the spread of debris will make the location of shelters and rescue of their occupants very difficult.

31 Here is another view at a distance of $\frac{3}{4}$ of a mile from ground zero before the explosion.

32 The same view after the explosion. The damage is severe, a large number of fires will be caused by the heat flash, which will produce many problems for those responsible for rescue work.

33 Here is a third view $1\frac{1}{2}$ miles from ground zero.

34 Here it is after the explosion. Windows broken, roofing damaged, doors blown off their hinges. Structural damage to main walls of buildings is unlikely to be heavy. In this area a number of small fires would be started by the heat flash entering windows of the upper and therefore more exposed floors.

35 No mention has yet been made of casualties. In Hiroshima the aircraft carrying the Atom Bomb was mistakenly thought to be a reconnaissance plane and the population did not take cover. That mistake cost many thousands of lives. In the following lectures, you will see how well organised Civil Defence could and would reduce casualties.

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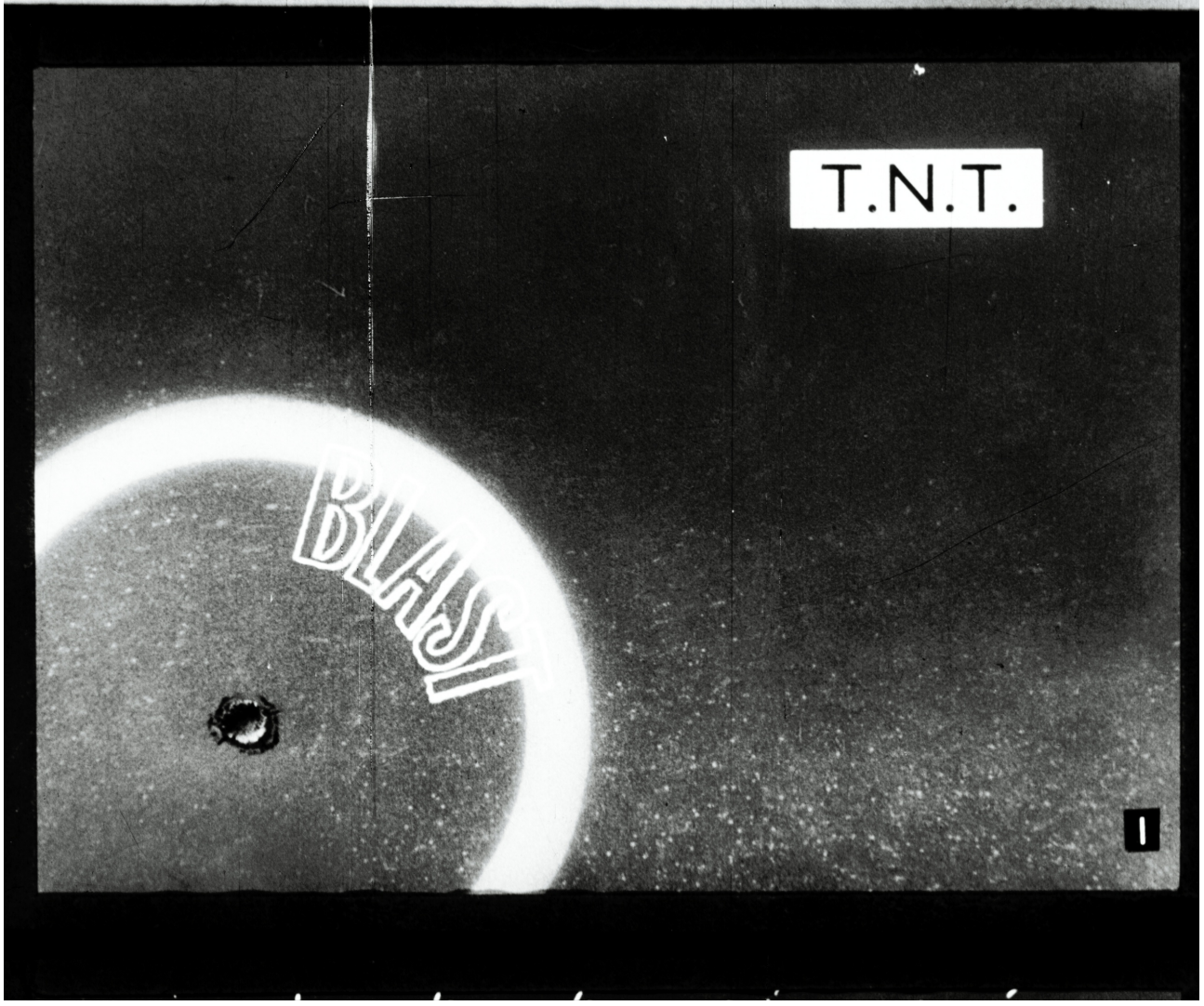
THE ATOM BOMB ITS EFFECTS AND HOW TO MEET THEM

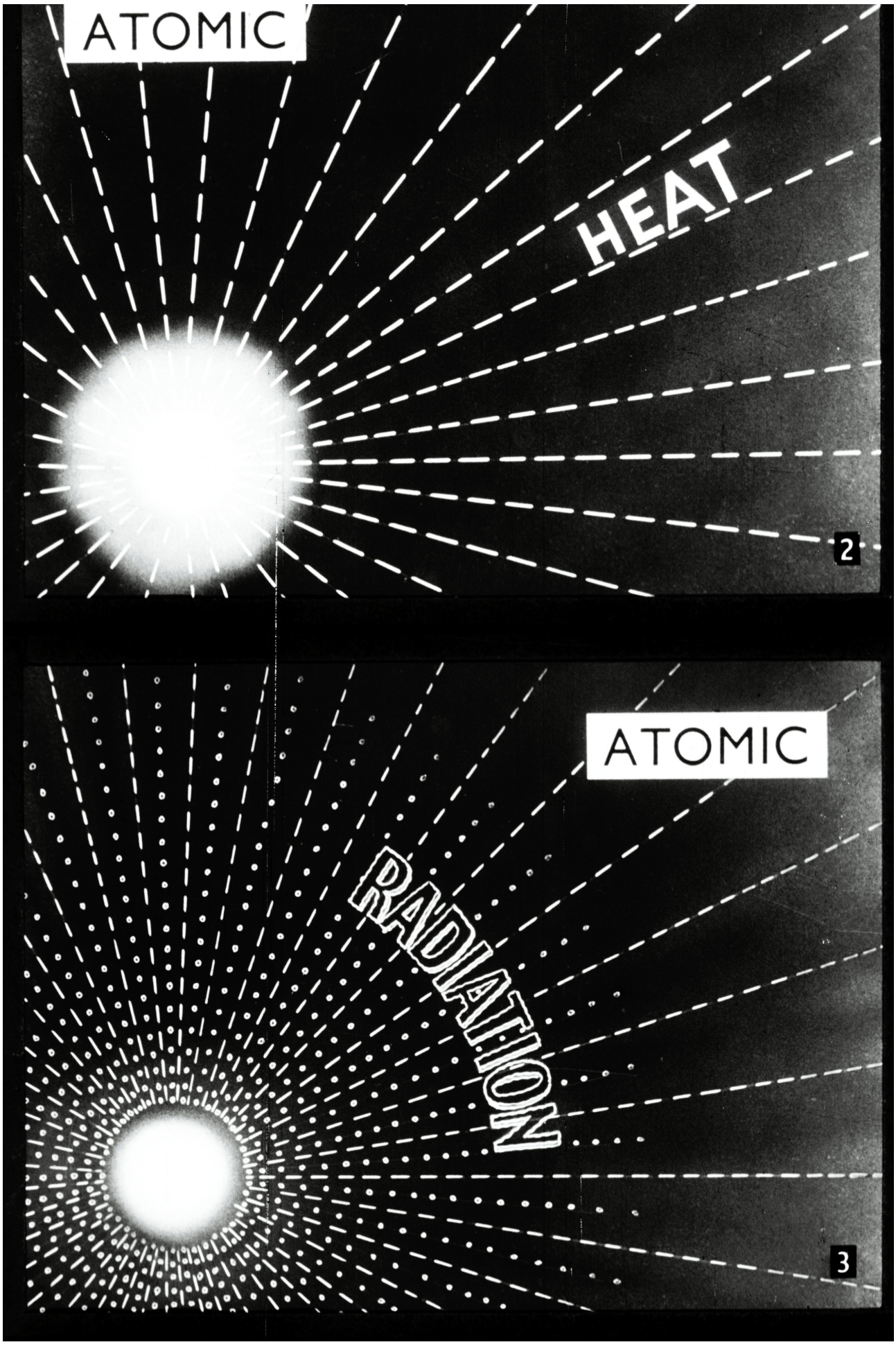
PART I

INTRODUCTION

March 1953

CD 31




ATOMIC
HEAT
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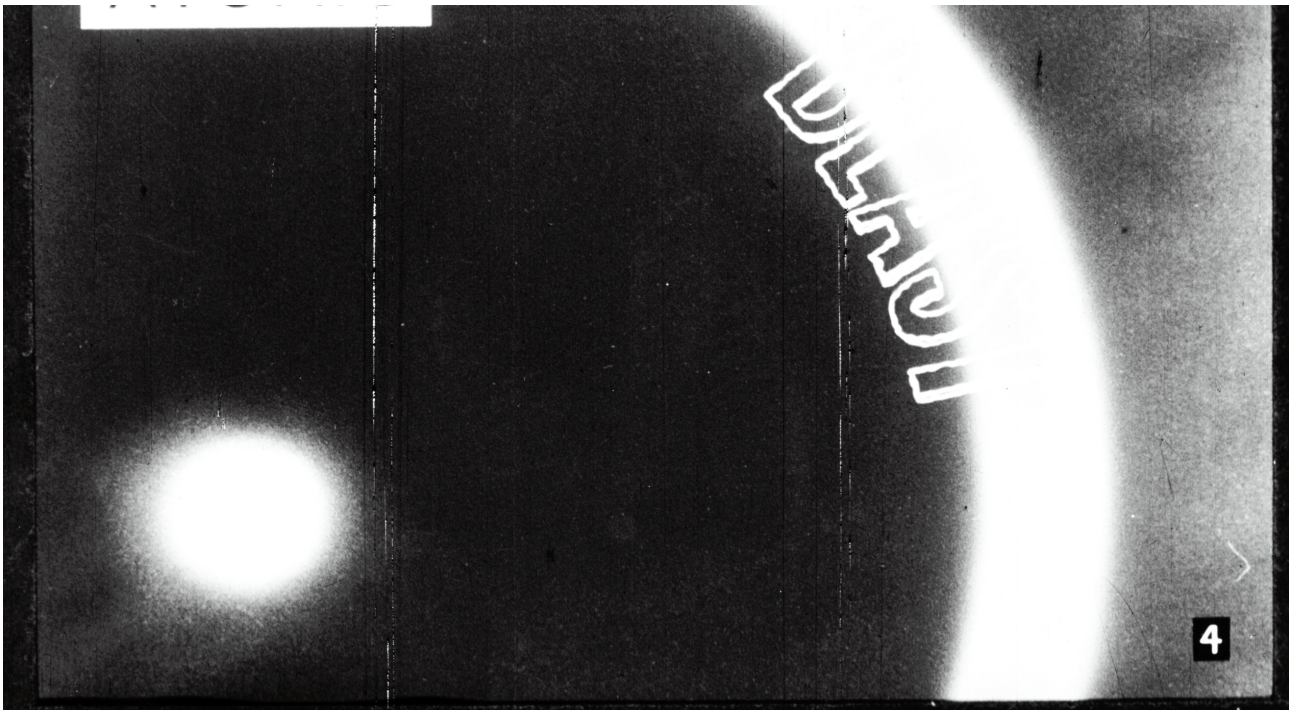
ATOMIC
RADIATION
3



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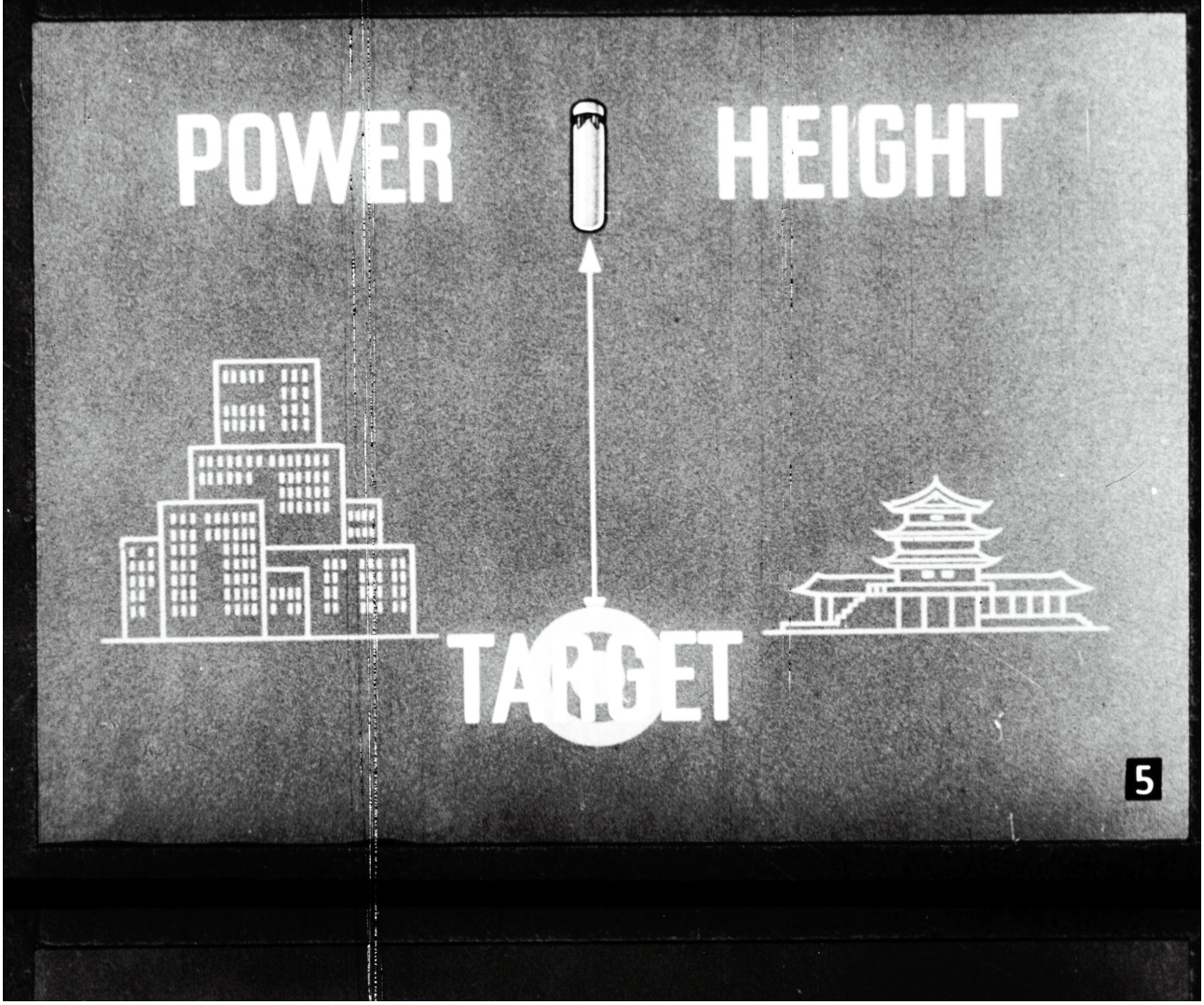

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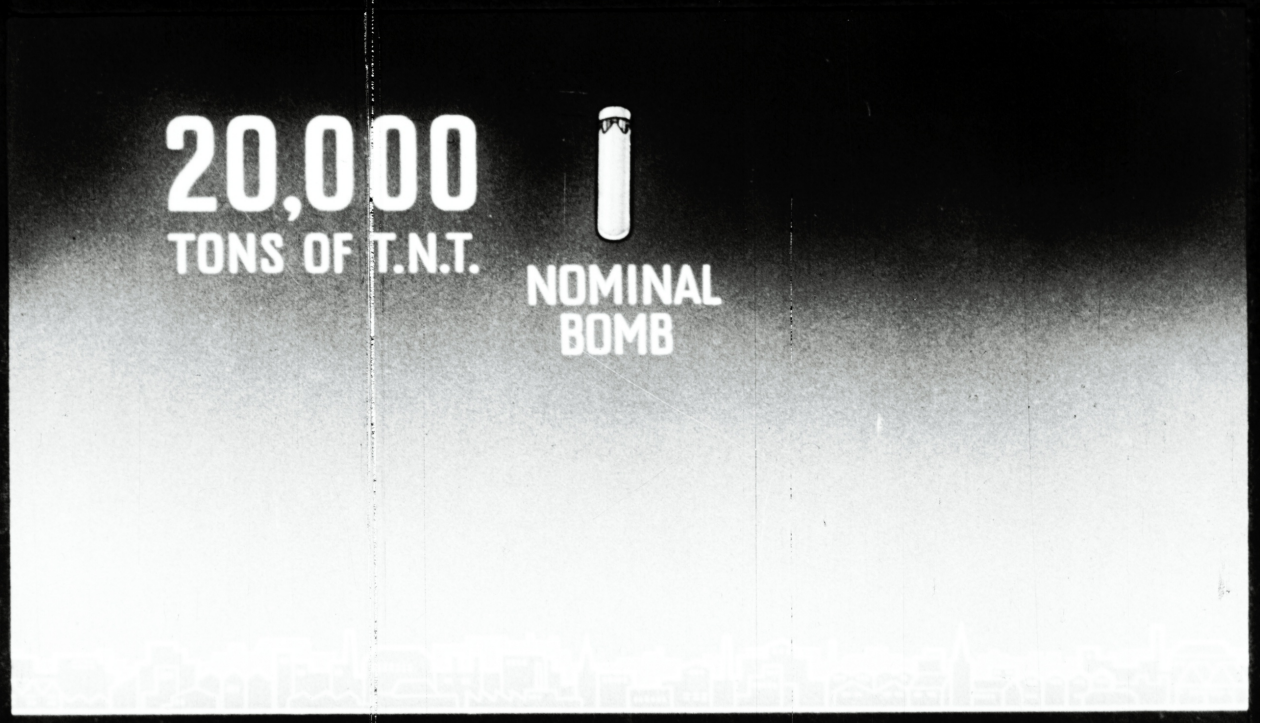
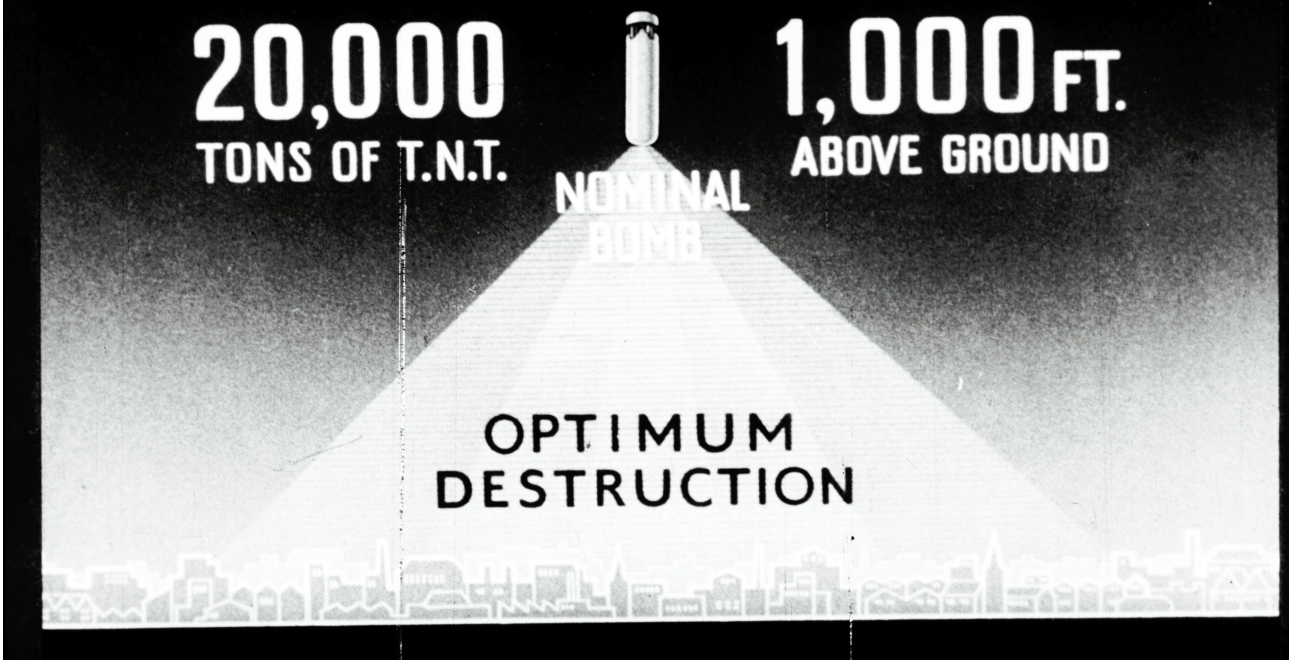
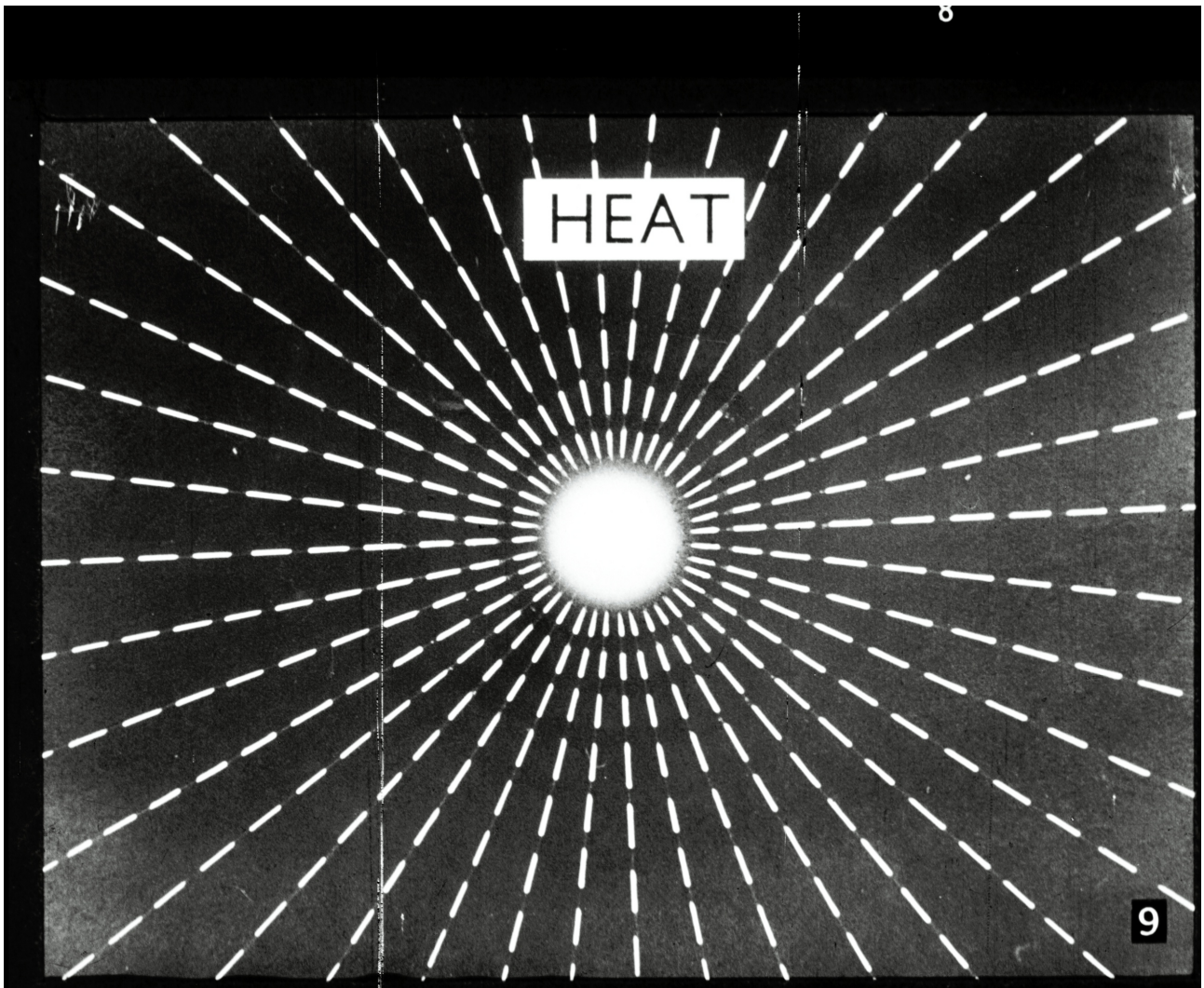

20,000
TONS OF T.N.T.
NOMINAL
BOMB

6


20,000
TONS OF T.N.T.
NOMINAL
BOMB
1,000 FT.
ABOVE GROUND
OPTIMUM
DESTRUCTION


HEAT
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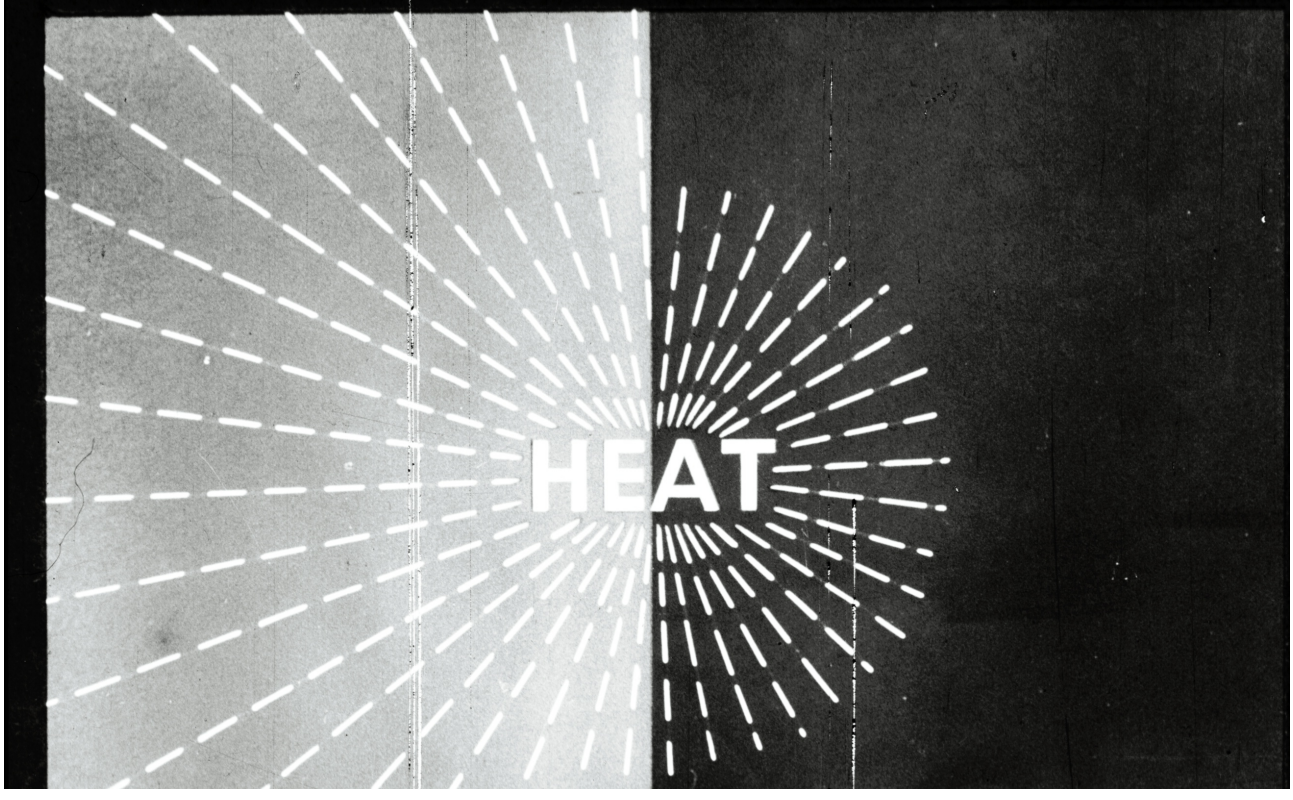
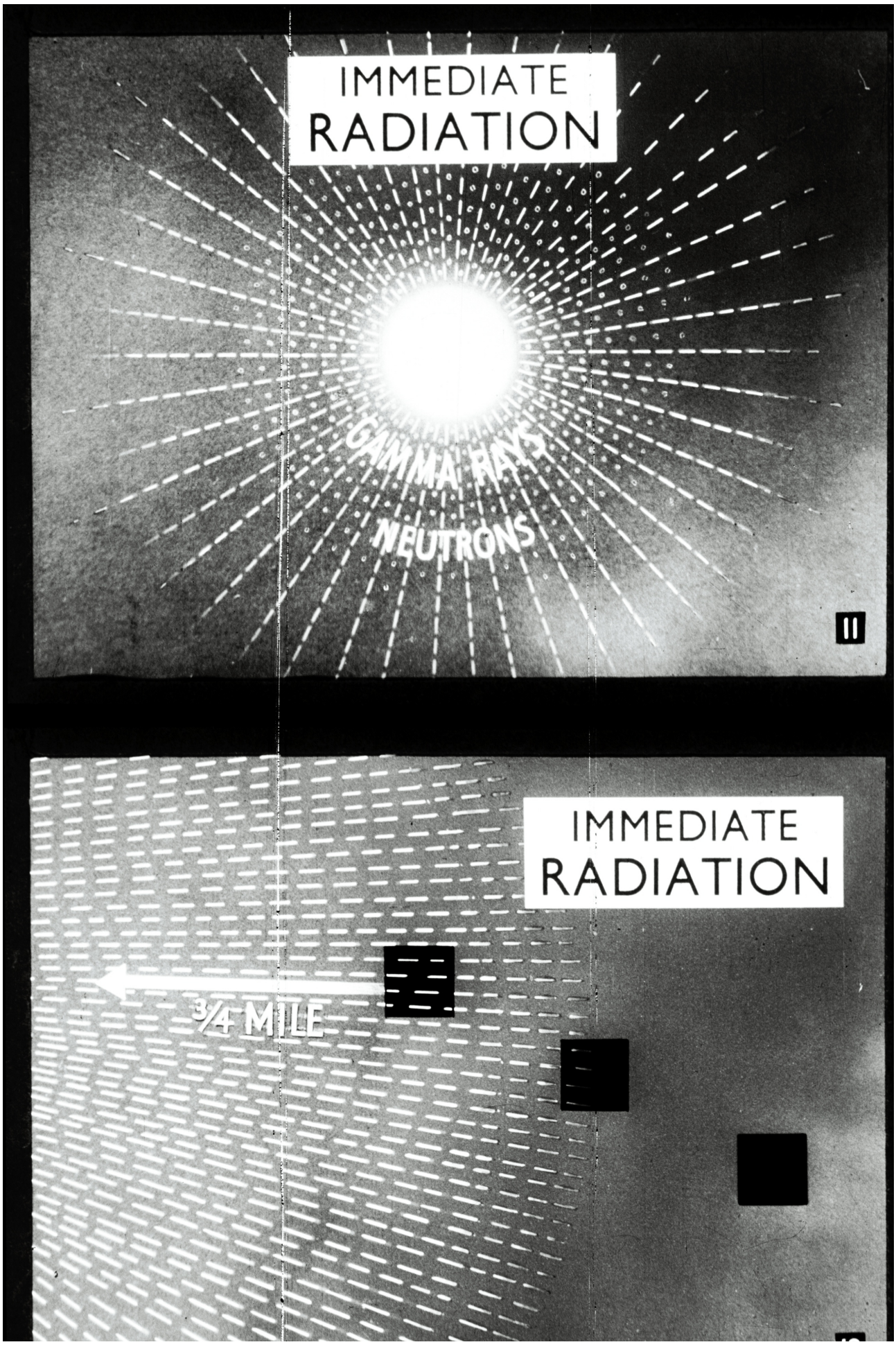
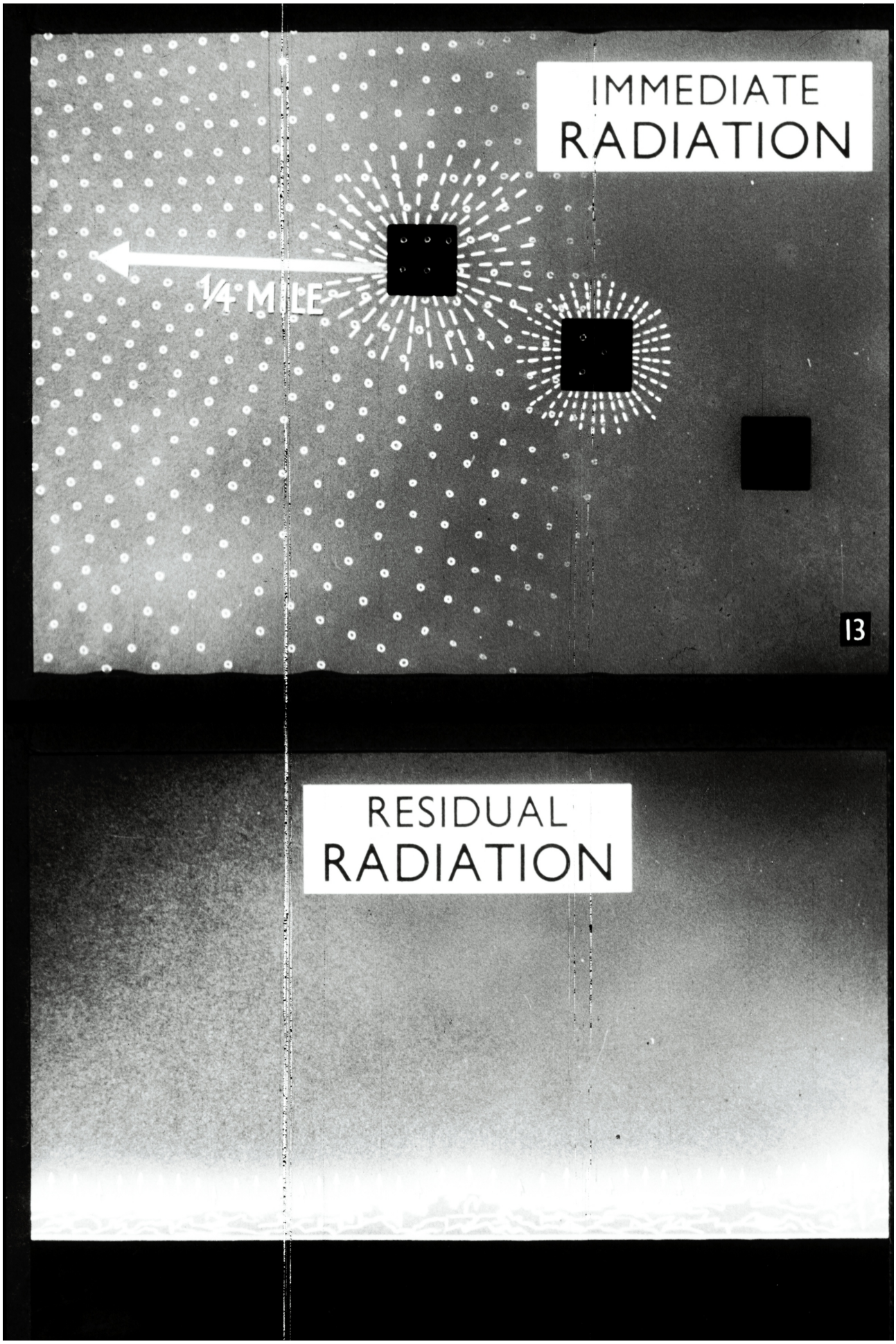
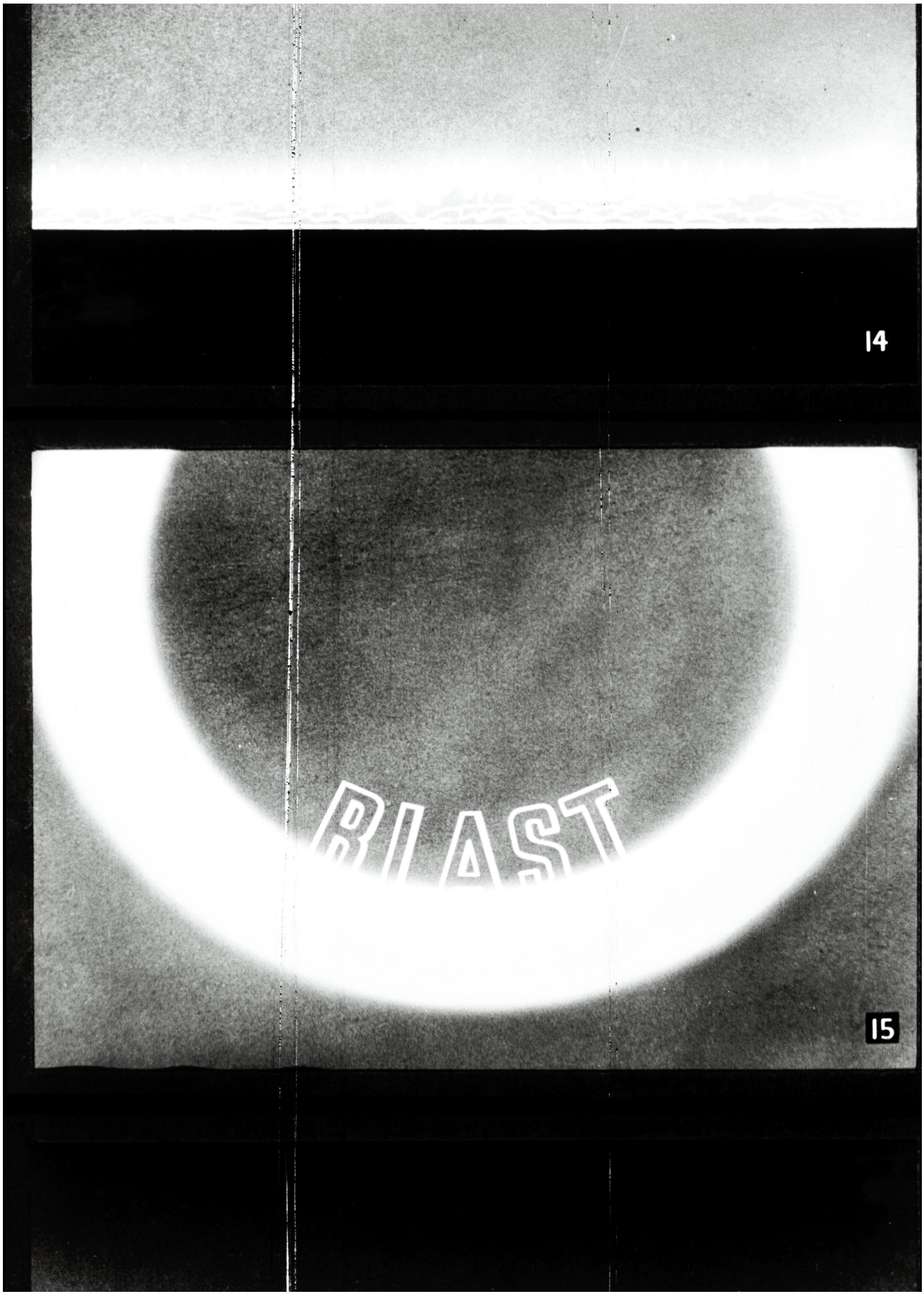
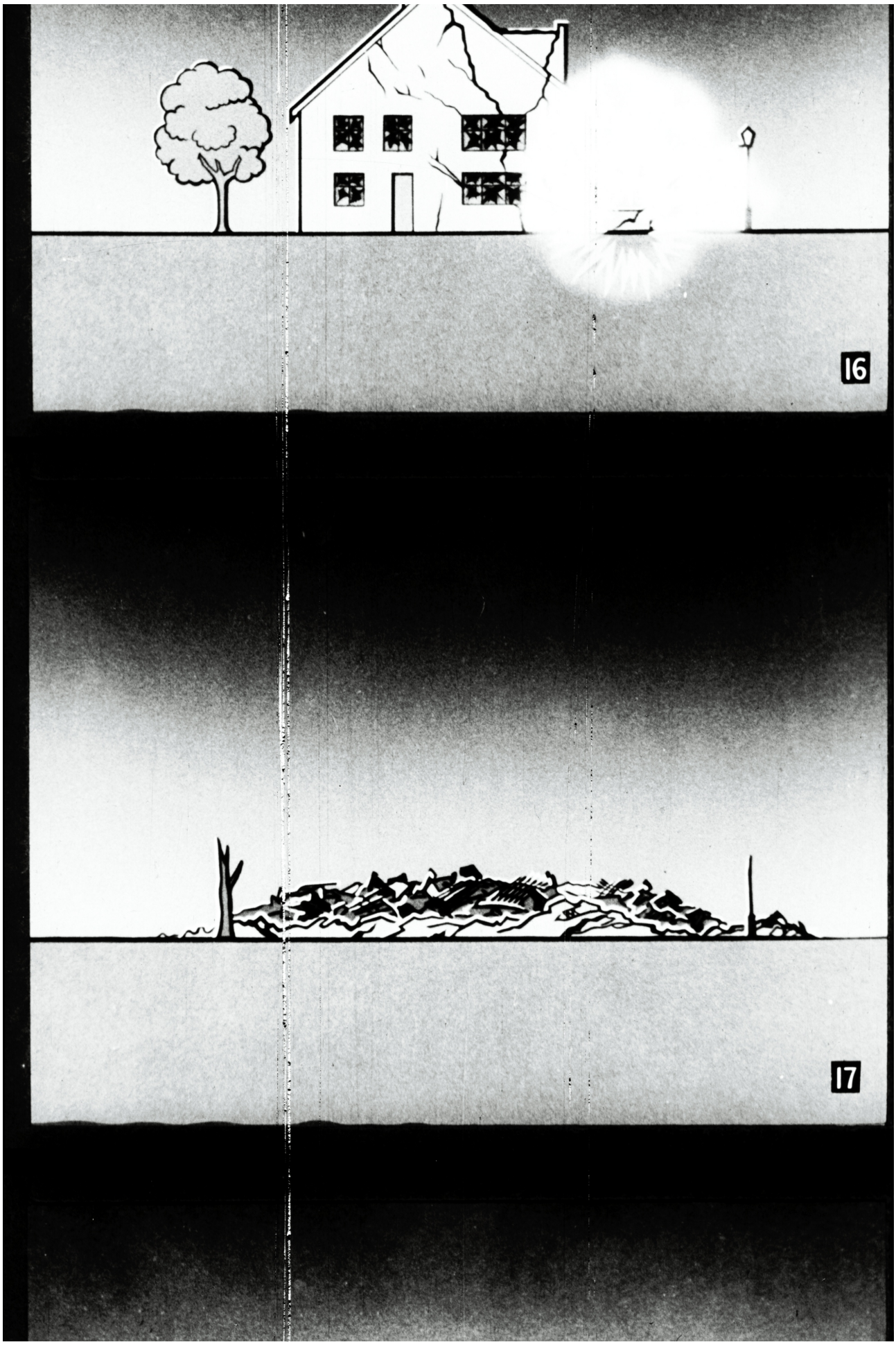

HEAT


IMMEDIATE
RADIATION
GAMMA RAYS
NEUTRONS
11
IMMEDIATE
RADIATION
3/4 MILE


IMMEDIATE
RADIATION
¼ MILE
13
RESIDUAL
RADIATION


14
BLAST
15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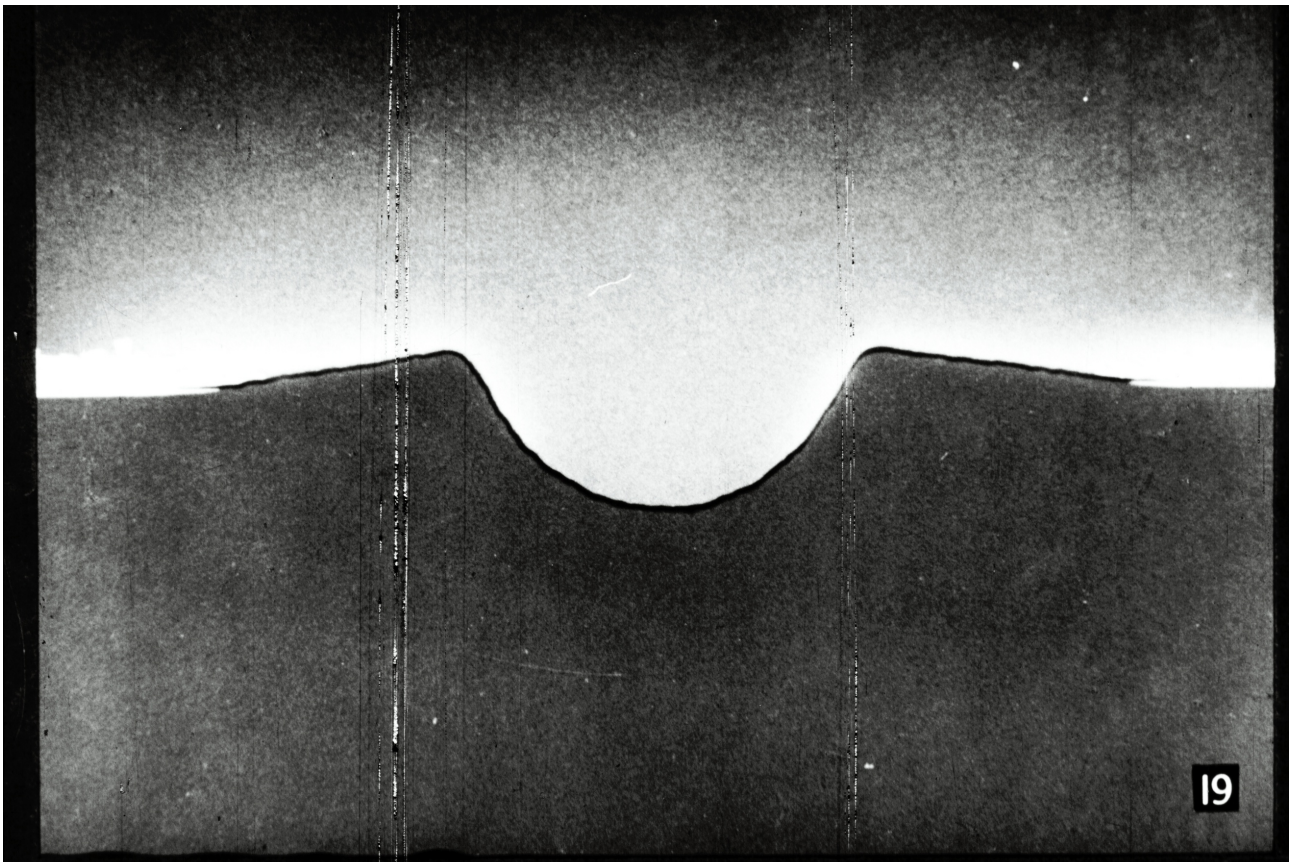

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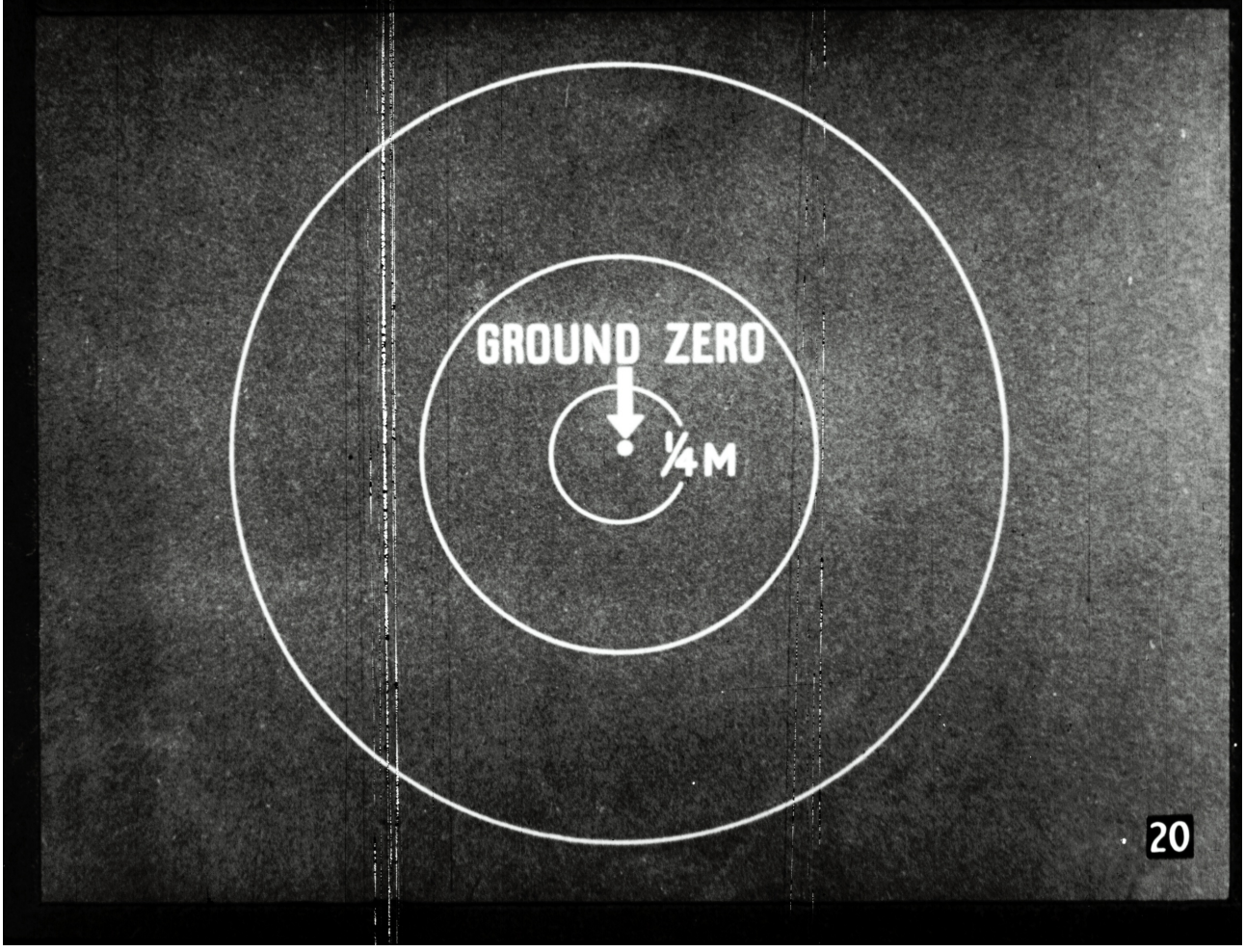

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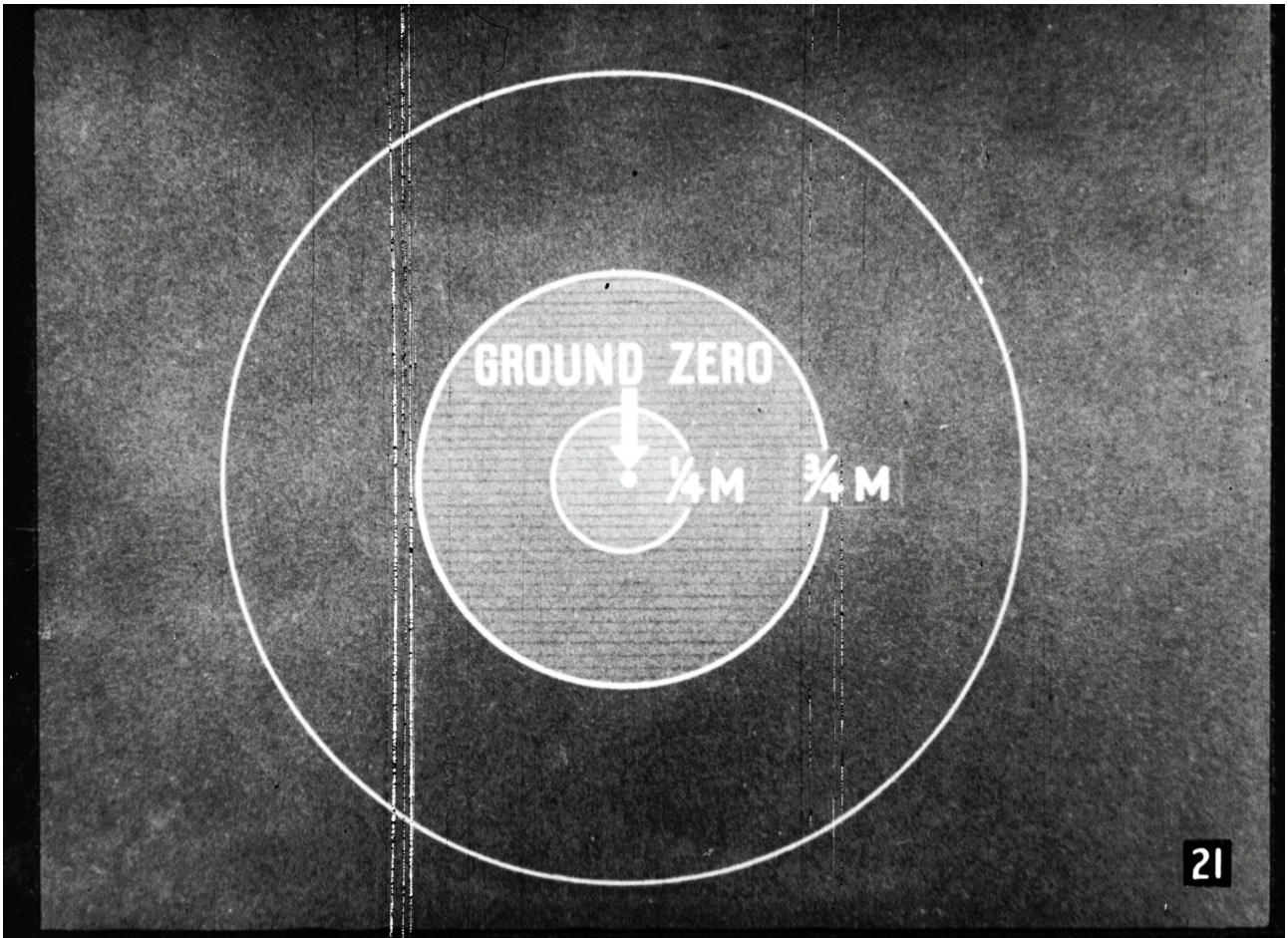

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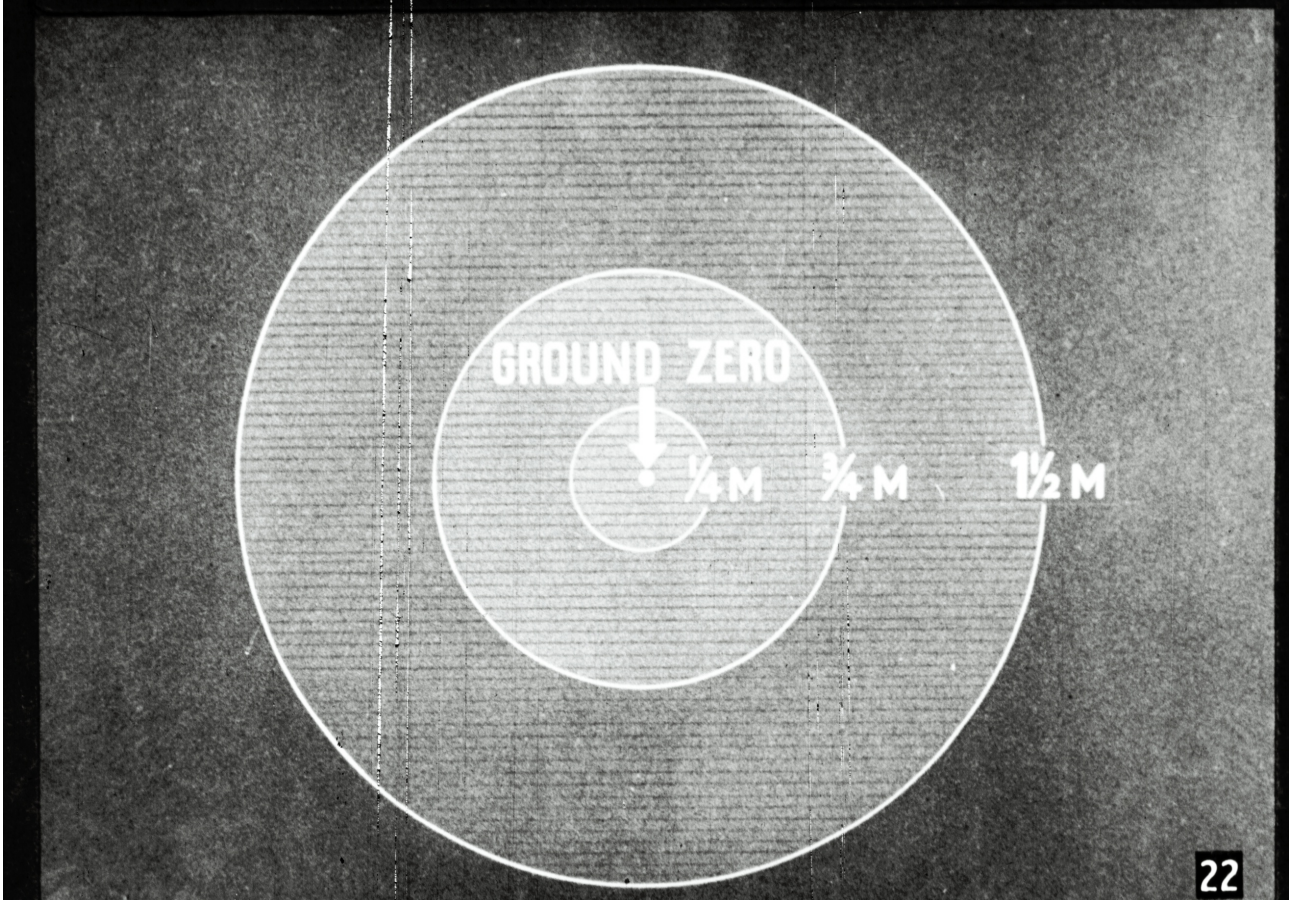

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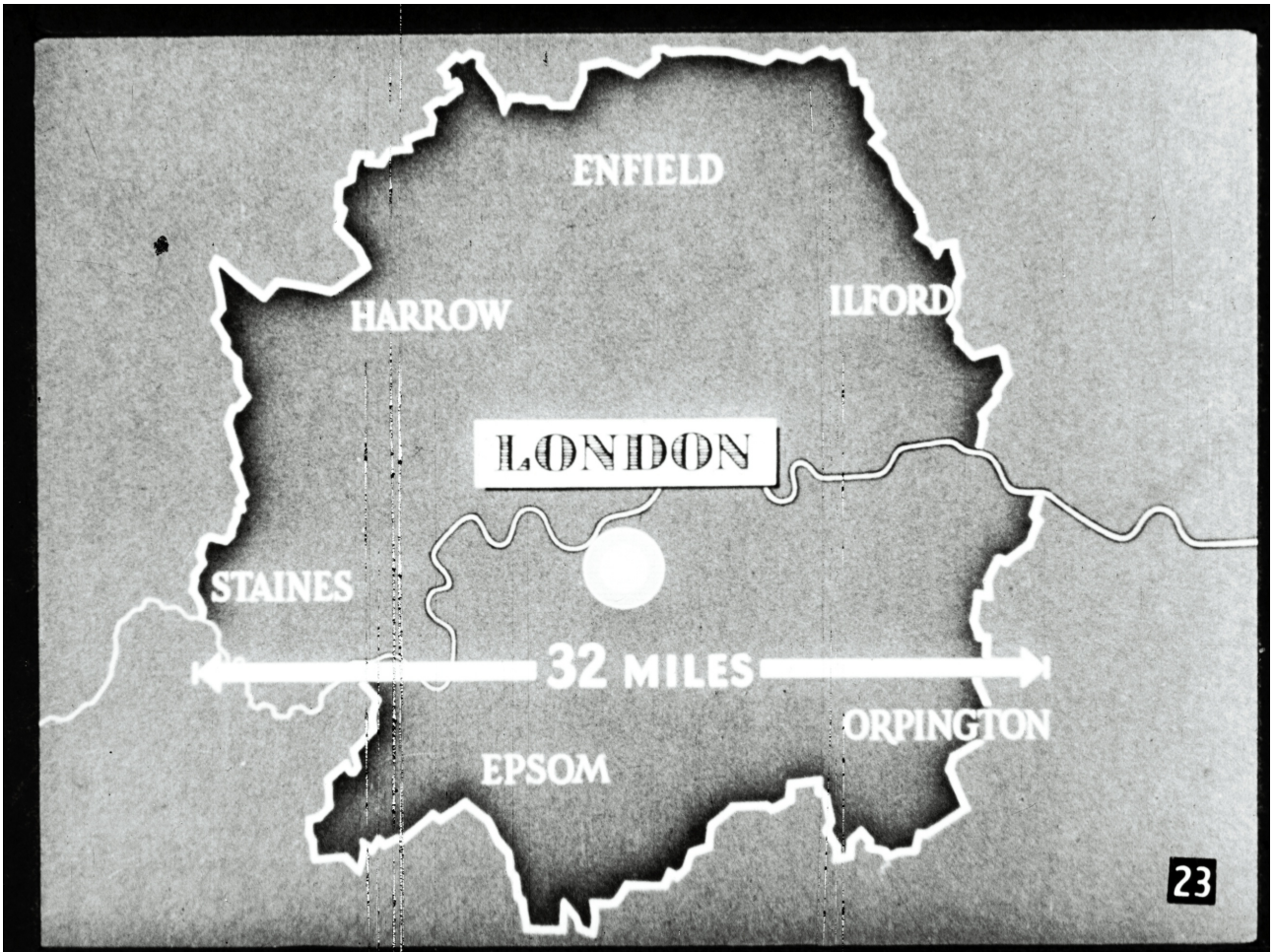
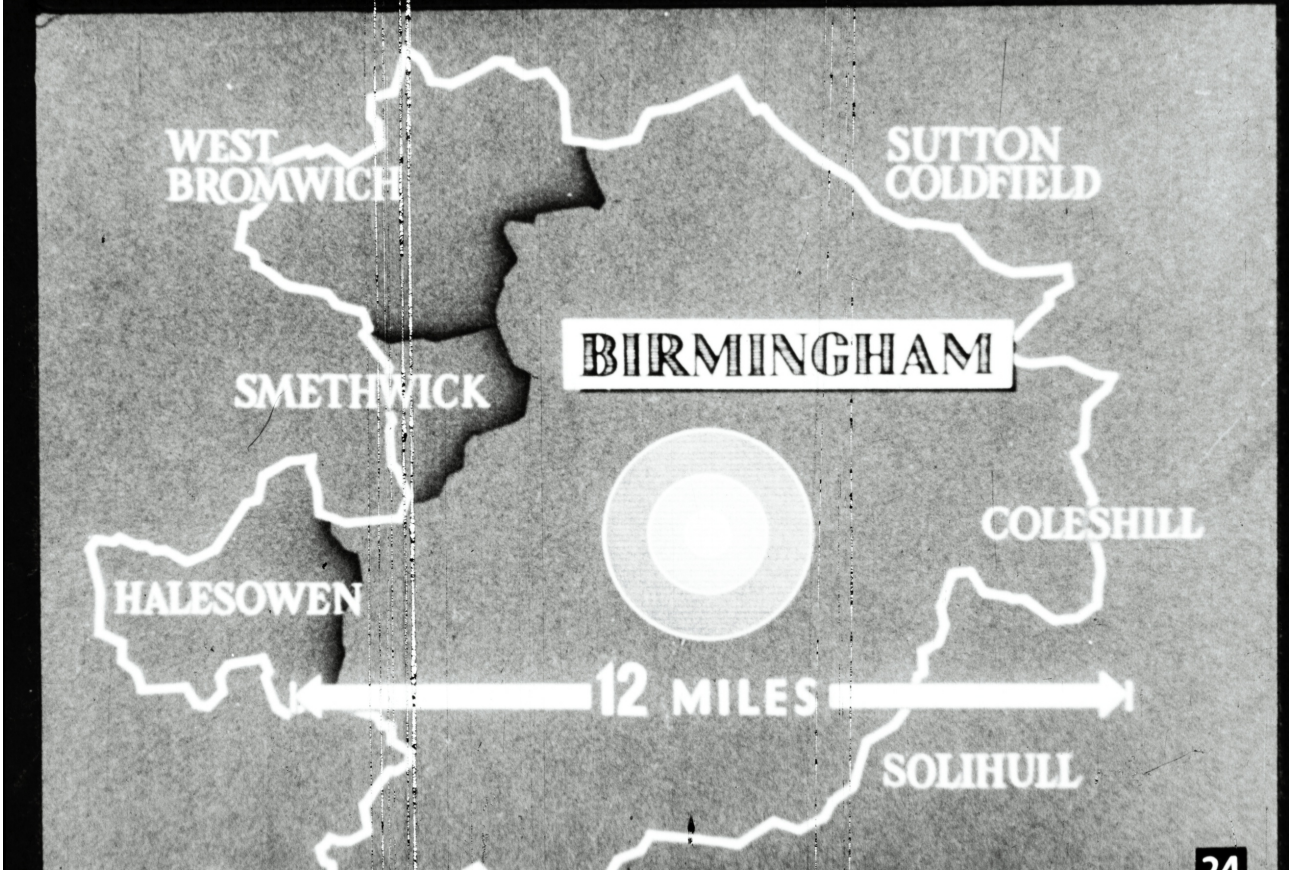

ENFIELD
HARROW
ILFORD
LONDON
STAINES
32 MILES
ORPINGTON
EPSOM
23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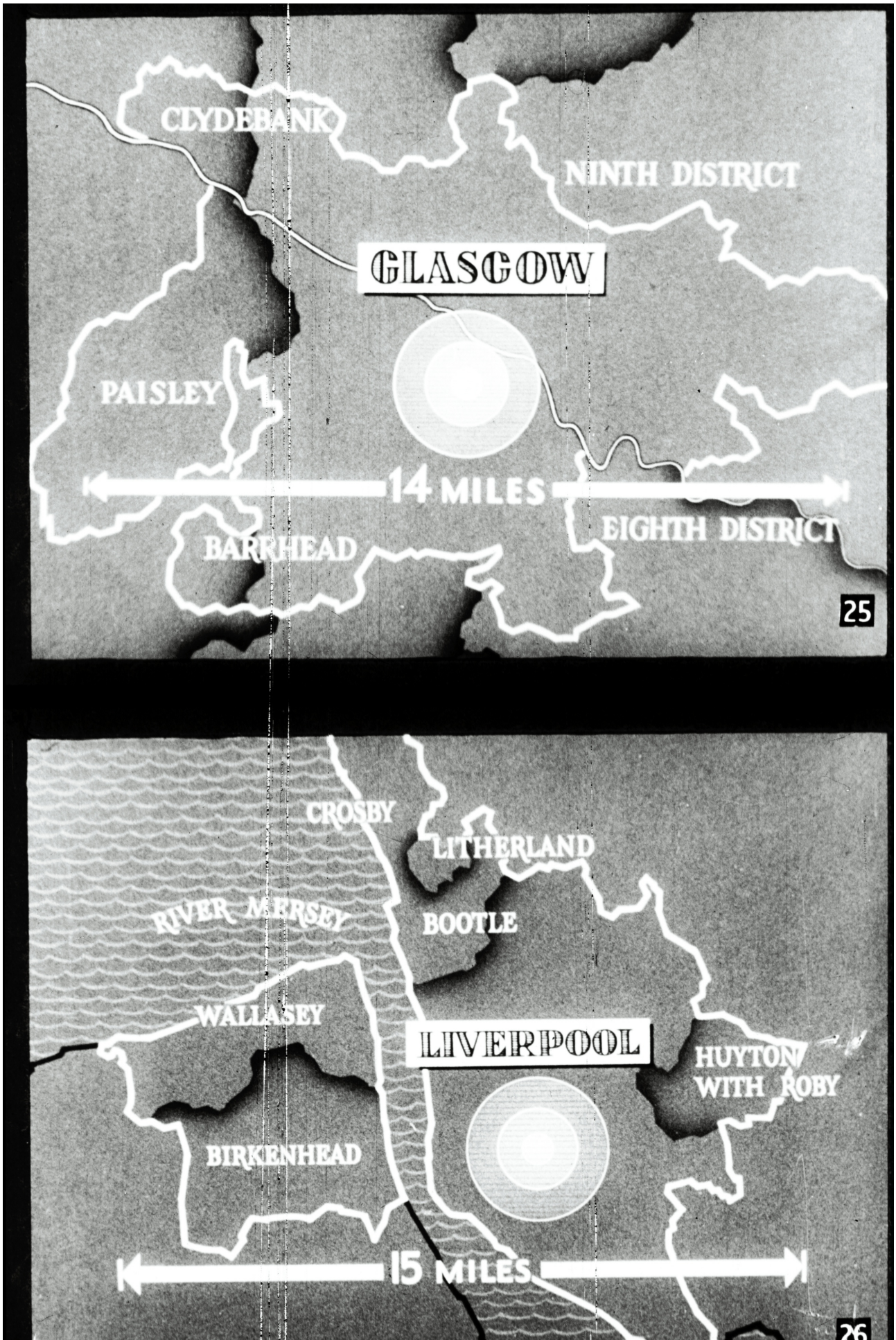
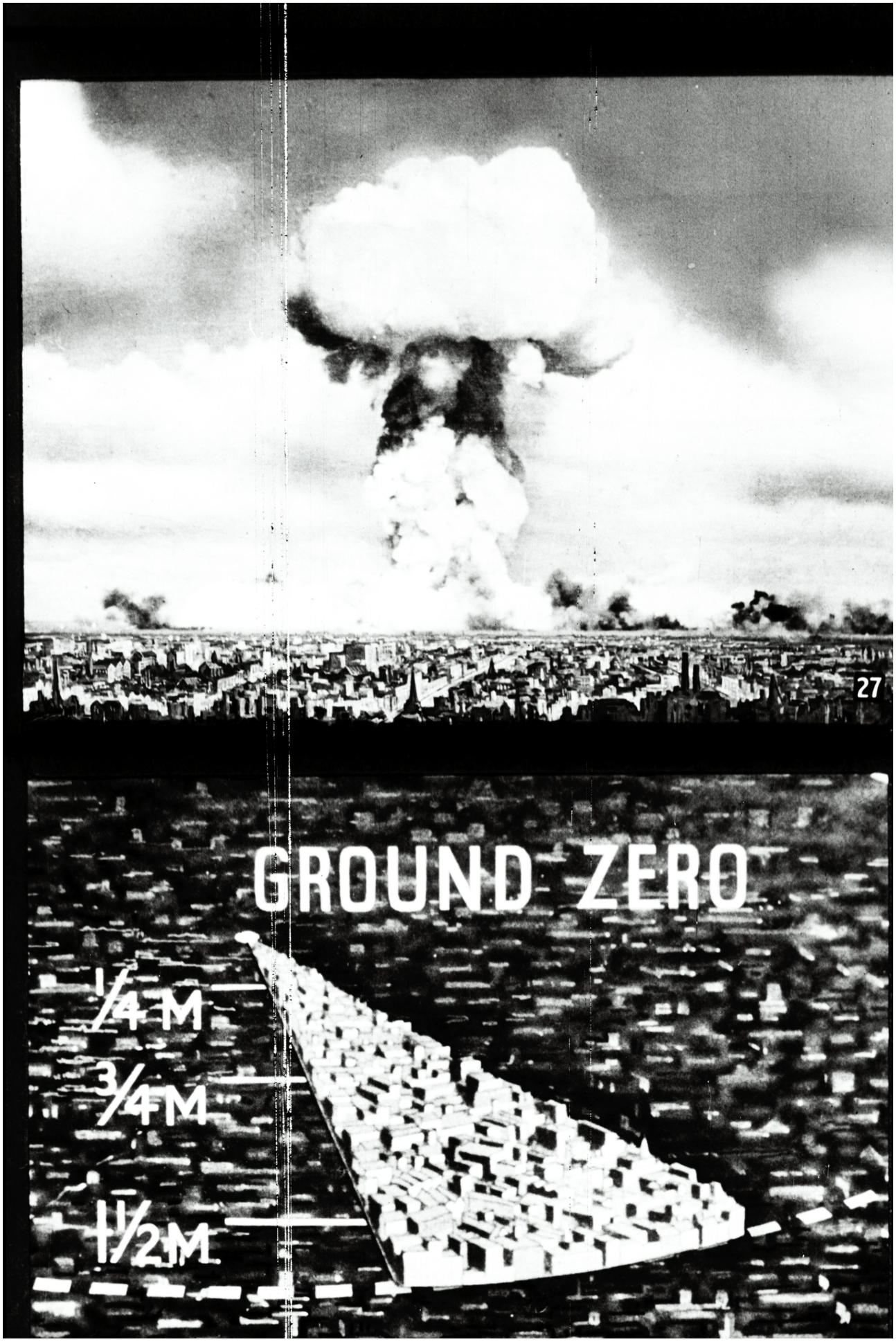
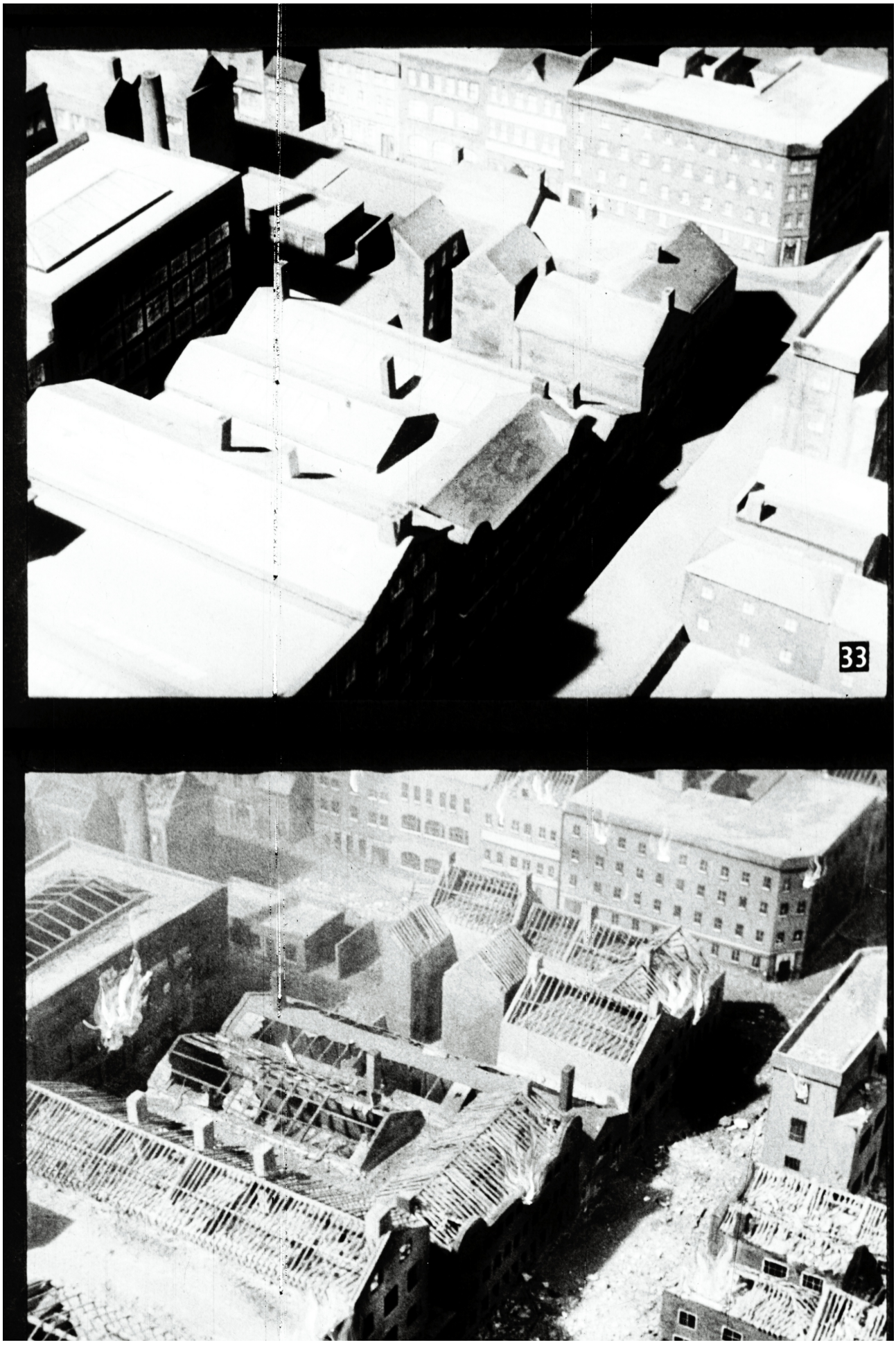
BIRMINGHAM
SMETHWICK
COLESHILL
HALESOWEN
12 MILES
SOLIHULL


CLYDEBANK
NINTH DISTRICT
GLASGOW
PAISLEY
14 MILES
EIGHTH DISTRICT
BARRHEAD
25
CROSBY
LITHERLAND
RIVER MERSEY
BOOTLE
WALLASEY
LIVERPOOL
HUYTON WITH ROBY
BIRKENHEAD
15 MILES
26


27
GROUND ZERO
1/4M
3/4M
1 1/2M

MORTONS
29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THE END